for a greener tomorrow

Compact efficient CO_2 amplifiers with modular design for high-efficient EUV power generations

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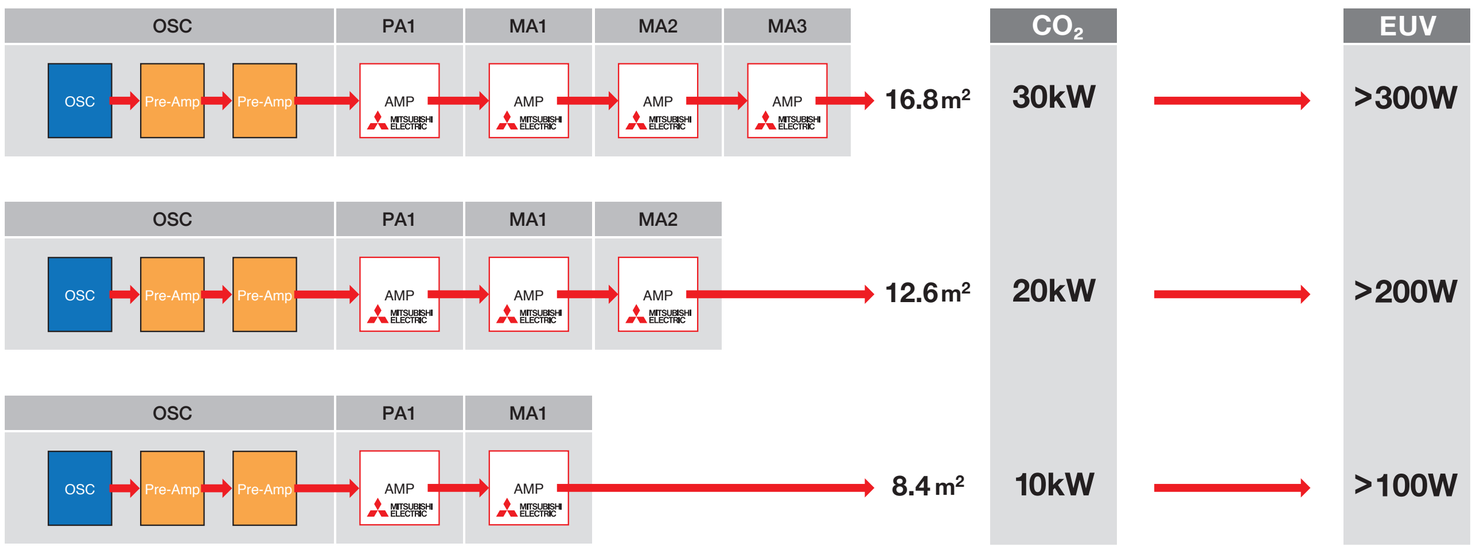
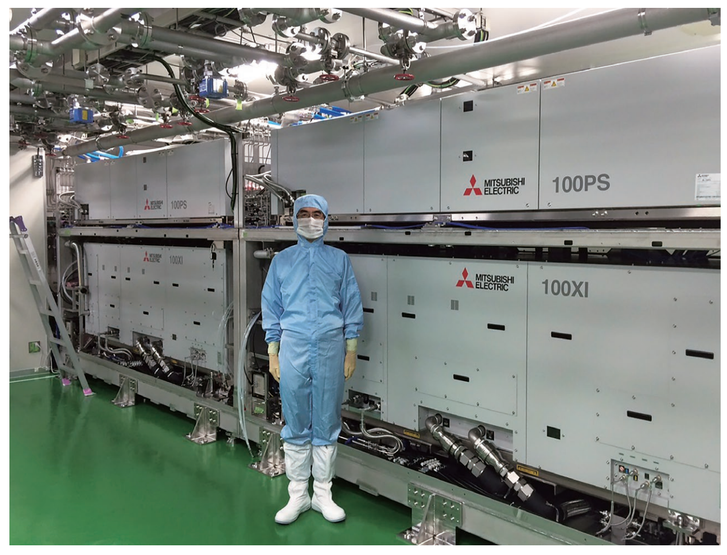
Abstract

CO_2 amplifiers have been developed and the performances are confirmed for EUV generation systems so that they could be adapted for commercial applications. Based on transverse-gas flow design, electrically efficient operation and compact foot space compared with conventional lasers are achieved. At the workshop, we are also going to discuss the modular design for the variety of process conditions. Our basic system generates CO_2 powers of 5-10kW and simply by adding same three amplifiers, the CO_2 powers can be increased at least 10kW per each amplifier so that total powers of more than 35-40kW could be generated. Therefore, today's 250W EUV applications could be generated adapting three amplifiers. However, if the EUV power of 100W is enough for some lithography conditions, it should be selectable by applying one amplifier and the EUV power can be enhanced easily by adding more amplifiers in the near future if higher EUV power is required.

Modular & Compact Design





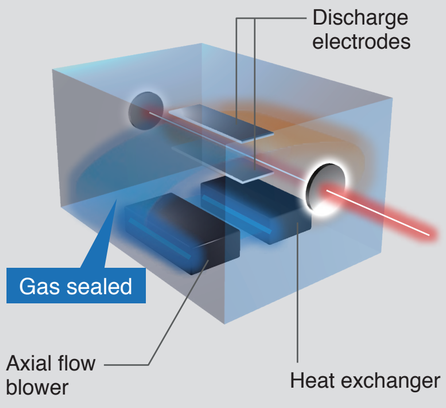
Advantages of our CO_2 laser source #1

Technological Advantages

- ✓ Higher Gain
- ✓ Lower loss
- ✓ Better beam shapes

Transverse-gas flow excitation system oscillator

Mitsubishi's original technology

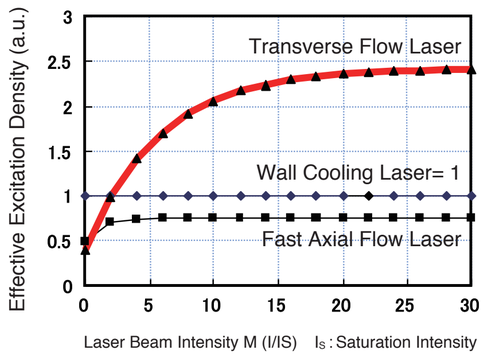


User Advantages

- ✓ Higher Power > 25kW with better efficiency
- ✓ Stable Operations
- ✓ High EUV power with better efficiency

Advantages of our CO_2 laser source #2

Theoretical calculation to explain electrical input power reduction of 50% compared with other CO_2 lasers

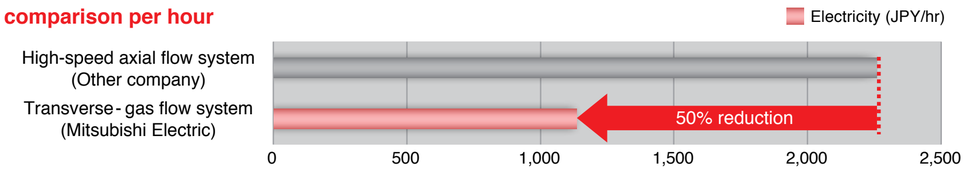


$$\frac{\frac{v}{\lambda}\left\{1+\frac{\lambda}{v}(W-l)-e^{-\frac{l\lambda}{v}}\left(1-e^{-\frac{(1+M)(r-l)\lambda}{v}}\right)-\frac{e^{-\frac{(1+M)(r-l)\lambda}{v}}}{1+M}\left(M+e^{\frac{(1+M)(W-l)\lambda}{v}}\right)\right\}}{(r-l)}$$

ααα

$$\frac{(1+M)W+\frac{v}{\lambda}e^{-\frac{(1+M)L\lambda}{v}}\left(1-e^{\frac{(1+M)W\lambda}{v}}\right)}{(1+M)L}$$

Operation cost comparison per hour



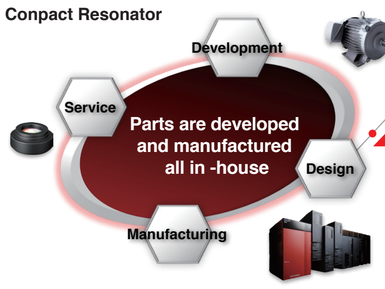
Welcome to Nagoya Works

Mitsubishi Electric Co., Ltd.
Nagoya Works

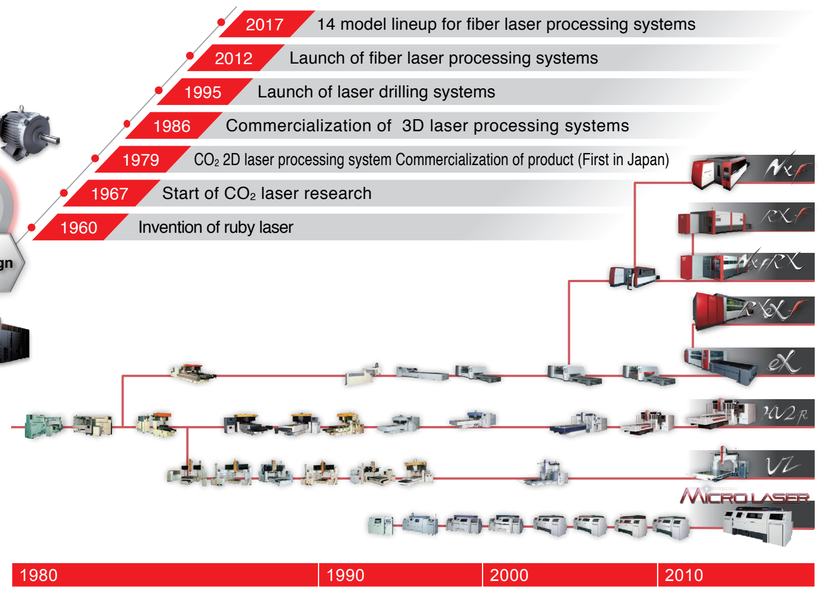
Mitsubishi Electric FA products produced here
To the world's production field

History of Mitsubishi Laser

Conpact Resonator



CO_2 2D laser processing system Commercialization of product (First in Japan)



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